The Respiratory System

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طب عام ج/الكوفة

201. You are asked to evaluate an infant born vaginally 3 hours previously to a mother whose only pregnancy complication was poorly controlled gestational diabetes. The nursing staff noticed that the infant was breathing abnormally. On examination, you find that the infant is cyanotic, has irregular, labored breathing, and has decreased breath sounds on the right side. You also note decreased tone in the right arm. You provide oxygen and order a stat portable chest radiograph, which is normal. Which of the following studies is most likely to confirm your diagnosis?

a. Nasal wash for viral culture
b. Fiberoptic bronchoscopy
c. Chest CT
d. Chest ultrasound
e. Induced sputum culture

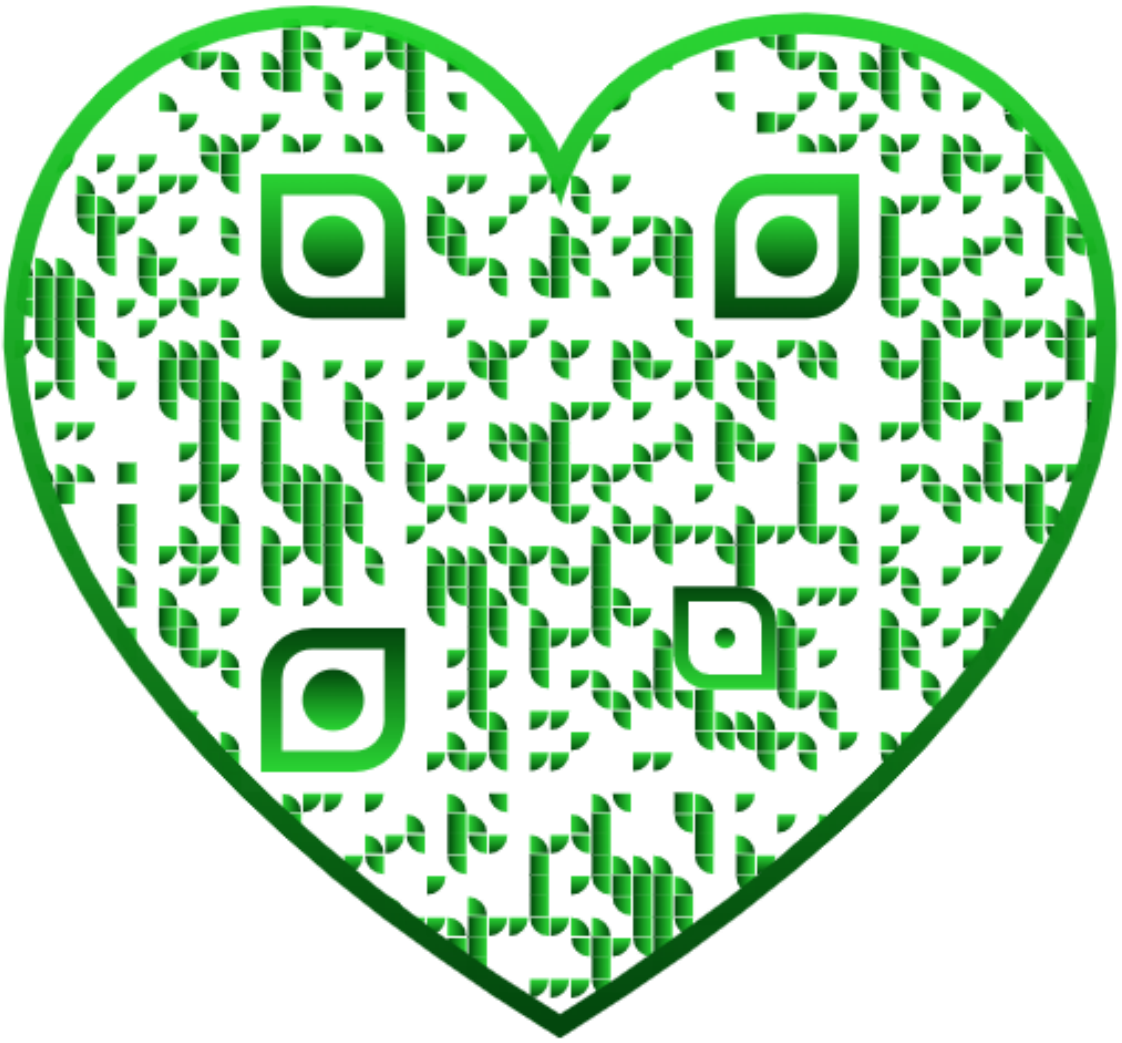
Infants born to mothers with gestational diabetes are at risk for being large for their gestational age and thus at increased risk for peripheral nerve injuries such as Erb-Duchenne and phrenic nerve paralysis.

202. A 10-month-old infant has poor weight gain, a persistent cough, and a history of several bouts of pneumonitis. The mother describes the child as having very large, foul-smelling stools for months. Which of the following diagnostic maneuvers is likely to result in the correct diagnosis of this child?

a. CT of the chest
b. Serum immunoglobulins
c. TB skin test
d. Inspiratory and expiratory chest x-ray
e. Sweat chloride test

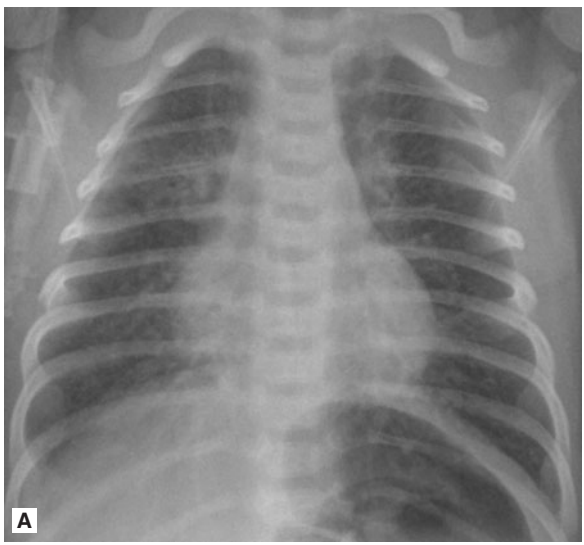
Cystic fibrosis

Need pancreatic enzyme replacement to stop fatty diarrhea



Bronchiolitis → <2 y.o / wheezing / runny nose / hyper-inflated chest

203. A previously well 1-year-old infant has had a runny nose and has been sneezing and coughing for 2 days. Two other members of the family had similar symptoms. Four hours ago, his cough became much worse. On physical examination, he is in moderate respiratory distress with nasal flaring, hyperexpansion of the chest, and easily audible wheezing without rales. His chest radiographs are shown. Which of the following is the appropriate next course of action?



(Courtesy of Susan John, MD.)

a. Monitoring oxygenation and fluid status alone
b. Inhaled epinephrine and a single dose of steroids
c. Acute-acting bronchodilators and a short course of oral steroids
d. Emergent intubation and antibiotics
e. Chest tube placement

204. A 6-year-old girl presents with a 2-day history of cough and fever. At your office she has a temperature of 39.4°C (103°F), a respiratory rate of 45 breaths per minute, and decreased breath sounds on the left side. Her chest x-ray is shown below. Which of the following is the most appropriate initial treatment?

(Courtesy of Susan John, MD.)

a. *N*-acetylcysteine chest physiotherapy
b. Vancomycin
c. Partial lobectomy
d. Postural drainage
e. Placement of tuberculosis skin test

The x-ray reveals a lung empyema on the left side, characterized by nearly complete white out of that side by the pleural or extrapleural fluid collection. Lung abscesses are usually caused by S aureus, S pneumoniae, or S pyogenes.

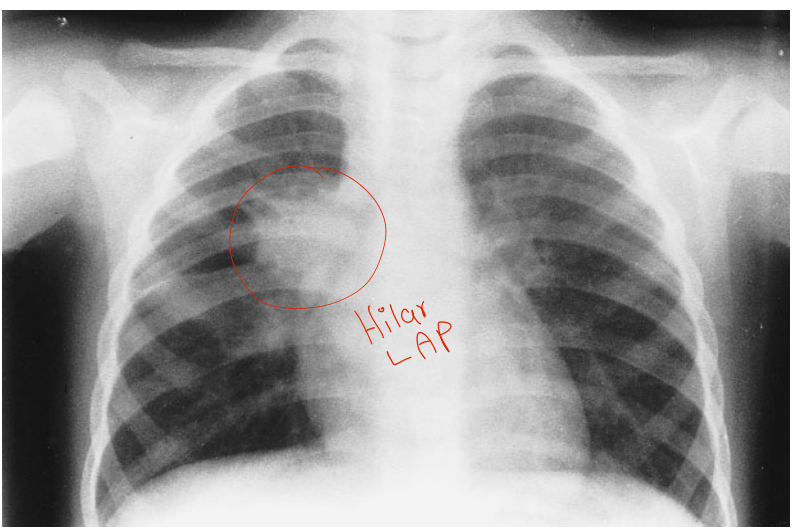
↳previously sensitive to penallin
now need vancomycin

205. A 2-year-old girl is playing in the garage with her Chihuahua, only partially supervised by her father, who is weed-whacking around the garden gnomes in the front yard. He finds her in the garage, gagging and vomiting. She smells of gasoline. In a few minutes she stops vomiting, but later that day she develops cough, tachypnea, and subcostal retractions. She is brought to your emergency center. Which of the following is the most appropriate first step in management?

a. Administer charcoal
b. Begin nasogastric lavage
c. Administer ipecac
d. Perform pulse oximetry and arterial blood gas
e. Administer gasoline-binding agent intravenously

Hydrocarbons with low viscosity and high volatility are the most likely agents to cause respiratory symptoms. Gasoline, kerosene, and furniture polish (which contain hydrocarbons) are common agents responsible for hydrocarbon aspiration. Hydrocarbon aspiration can produce dyspnea, cyanosis, and respiratory failure. Treatment is symptomatic, sometimes requiring intubation and mechanical ventilation. Induction of emesis is contraindicated,

206. A 3-year-old girl is admitted with the x-ray shown below. The child lives with her parents and a 6-week-old brother. Her grandfather stayed with the family for 2 months before his return to the West Indies 1 month ago. The grandfather had a 3-month history of weight loss, fever, and hemoptysis. Appropriate management of this problem includes which of the following?



a. Bronchoscopy and culture of washings for all family members
b. Placement of a Mantoux test on the 6-week-old sibling
c. Isolating the 3-year-old patient for 1 month
d. Treating the 3-year-old patient with isoniazid (INH) and rifampin
e. HIV testing for all family members

Bcz active TB

207. You are asked to evaluate a 4-year-old boy admitted to your local children's hospital with a diagnosis of pneumonia. The parents state that the child has had multiple, intermittent episodes of fever and respiratory difficulty over the past 2 years, including cyanosis, wheezing, and dyspnea; each episode lasts for about 3 days. During each event he has a small amount of hemoptysis, is diagnosed with left lower lobe pneumonia, and improves upon treatment. Repeat radiographs done several days after each event are reportedly normal. His examination on the current admission is significant for findings similar to those described above, as well as digital clubbing. Which of the following is the most appropriate primary recommendation?

a. Intravenous cephalosporin and oral macrolide therapy
b. Modified barium swallow study to evaluate for aspiration
c. Nasal swab for viral culture
d. Incentive spirometry
e. Bronchoalveolar lavage

idiopathic pulmonary hemosiderosis (IPH). While fever, respiratory distress, and localized chest radiograph findings should point initially toward an acute pneumonia, the history of recurrence, the rapid clearing of radiographic findings, and the hemoptysis suggest pulmonary hemorrhage. The examination finding of digital clubbing suggests a chronic process. Other typical findings would include microcytic and hypochromic anemia, low serum iron levels, and occult blood in the stool (from swallowed pulmonary secretions). Bronchoalveolar lavage will reveal hemosiderin-laden macrophages and would be most likely to make the diagnosis.

208. A previously healthy, active, 18-month-old African American child presents with unilateral nasal obstruction and foul-smelling discharge. The child's examination is otherwise unremarkable. Which of the following is the most likely diagnosis?

a. Foreign body
b. Nasal polyps
c. Frontal sinusitis
d. Deviated septum
e. Choanal atresia

209. A 7-year-old child is brought by his mother for a school physical. His growth parameters show his height to be 50th percentile and his weight to be significantly higher than 95th percentile. His mother complains that he always seems sleepy during the day and that he has started complaining of headaches. His second-grade teacher has commented that he has difficulty staying awake in class. His mother complains that he wakes up the whole house with his snoring at night. Which of the following is the most appropriate next step in evaluating and managing this condition?

a. Try steroids to decrease tonsillar and adenoid hypertrophy.
b. Refer to an otolaryngologist for tonsillectomy and adenoidectomy.
c. Arrange for continuous positive airway pressure (CPAP) at home.
d. Arrange for home oxygen therapy for use at night.
e. Arrange for polysomnography.

210. You admitted to the hospital the previous evening a 1-year-old boy who presented with cough, fever, and mild hypoxia. At the time of his admission, he had evidence of a right upper lobe consolidation on his chest radiograph. A blood culture has become positive in less than 24 hours for *Staphylococcus aureus*. Approximately 20 hours into his hospitalization, the nurse calls you because the child has acutely worsened over the previous few minutes, with markedly increased work in breathing, increasing oxygen requirement, and hypotension. As you move swiftly to the child's hospital room, you tell the nurse to order which of the following?

a. A second chest radiograph to evaluate for pneumatocele formation
b. A large-bore needle and chest tube kit for aspiration of a probable tension pneumothorax
c. A change in antibiotics to include gentamicin
d. A sedative to treat the child's attack of severe anxiety
e. A thoracentesis kit to drain his probable pleural effusion

Tension pneumothorax, a recognized complication of staphylococcal (and other) pneumonia is caused by toxin production by the bacteria leading to rupture of the alveoli into the pleural space.

211. A fully immunized 2-year-old presents to the emergency room with several days of low-grade fever, barking cough, and noisy breathing. Over the past few hours he has developed a fever of 40°C (104°F) and looks toxic. He has inspiratory and expiratory stridor. The family has not noticed drooling, and he seems to be drinking without pain. Direct laryngoscopy reveals a normal epiglottis. The management of this disease process includes which of the following?

a. Intubation and intravenous antibiotics
b. Inhaled epinephrine and oral steroids
c. Inhaled steroids
d. Observation in a cool mist tent
e. Oral antibiotics and outpatient follow-up

Bacterial trachietis → تجمع بين اعراض croup + epiglottitis → but normal epiglottis at exam → So intubation

212. A 6-year-old, fully immunized boy is brought to the emergency room with a 3-hour history of fever to 39.5°C (103.1°F) and sore throat. The child appears alert, but anxious and toxic. He has mild inspiratory stridor and is drooling. He is sitting on the examination table leaning forward with his neck extended. A lateral radiograph of his neck is shown below. Which of the following is the most appropriate immediate management of this patient?

(Courtesy of Susan John, MD.)

a. Examine the throat and obtain a culture.
b. Obtain an arterial blood gas and start an IV line.
c. Administer a dose of nebulized epinephrine.
d. Prepare to establish an airway in the operating room.
e. Admit the child and place him in a mist tent.

213. A 4-year-old boy was admitted to the hospital last night with the complaint of "difficulty breathing." He has no past history of lung infection, no recent travel, and no day-care exposure; he does, however, have an annoying tendency to eat dirt. In the emergency center he was noted to be wheezing and to have hepatomegaly. He is able to talk, relaying his concern about his 6-week-old Chihuahua being left alone at home. Laboratory studies revealed marked eosinophilia (60% eosinophils). Which of the following tests is most likely to produce a specific diagnosis?

a. Tuberculin skin test
b. Histoplasmin test
c. ELISA for *Toxocara*
d. Silver stain of gastric aspirate
e. Stool examination for ova and parasites

214. A 10-year-old girl has had a "cold" for 14 days. In the 2 days prior to the visit to your office, she has developed a fever of 39°C (102.2°F), purulent nasal discharge, facial pain, and a daytime cough. Examination of the nose after topical decongestants shows pus in the middle meatus. Which of the following is the most likely diagnosis?

a. Brain abscess
b. Maxillary sinusitis
c. Streptococcal throat infection
d. Sphenoid sinusitis
e. Middle-ear infection

215. You are awakened in the night by your 2-year-old son, who has developed noisy breathing on inspiration, marked retractions of the chest wall, flaring of the nostrils, and a barking cough. He has had a mild upper respiratory infection (URI) for 2 days. Which of the following therapies is indicated?

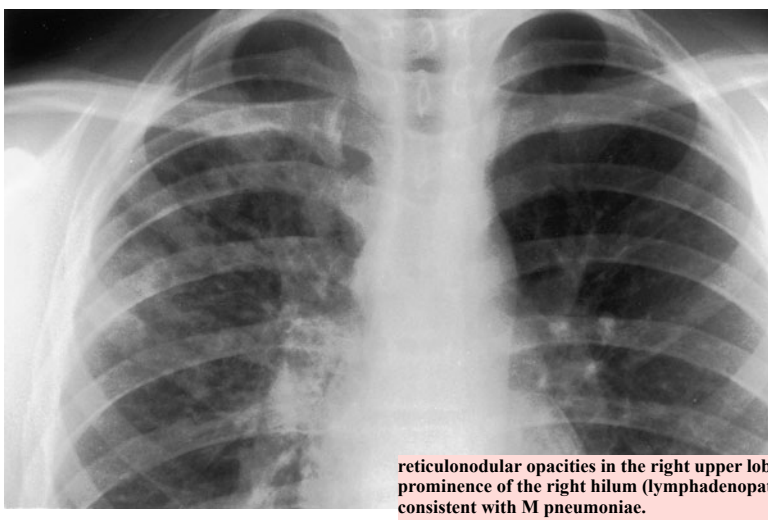
a. Short-acting bronchodilators and a 5-day course of steroids
b. Intubation and antibiotics
c. Observation for hypoxia and dehydration alone
d. Inhaled epinephrine and a dose of steroids **Croup**
e. Rigid bronchoscopy

216. An 8-year-old girl presents with well-controlled, moderately persistent asthma. Her therapies consist of occasional use of short-acting β-agonists, daily inhaled steroids, and a leukotriene inhibitor. She presents with white patches on her buccal mucosa. You recommend which of the following?

a. HIV testing
b. Tuberculosis skin testing
c. Measurement of serum immunoglobulins
d. Discontinuation of all her asthma medications
e. Rinse her mouth after use of her inhaled medications

Candidiasis
Oral thrush due to inhaled cortisol so wash mouth after use it

217. A 13-year-old develops fever, malaise, sore throat, and a dry, hacking cough over several days. He does not appear to be particularly sick, but his chest examination is significant for diffuse rales and rhonchi. The chest radiograph is shown below. Which of the following is the most likely pathogen?



reticulonodular opacities in the right upper lobe and prominence of the right hilum (lymphadenopathy) consistent with M pneumoniae.

(Courtesy of Susan John, MD.)

a. *Staphylococcus aureus* → occur in < 6 months.
b. *Mycobacterium tuberculosis*
c. *Haemophilus influenzae*
d. *Streptococcus pneumoniae* → cause pleural effusion
e. *Mycoplasma pneumoniae* in older child / give Macrolids

218. You have just given a 10-year-old boy an injection of pollen extract as prescribed by his allergist. You are about to move on to the next patient when the boy starts to complain about nausea and a funny feeling in his chest. You note that his face is flushed and his voice sounds muffled and strained. Which of the following is the first priority in managing this episode of anaphylaxis?

a. Preparation for endotracheal intubation
b. Intramuscular injection of diphenhydramine
c. Administration of oxygen
d. Subcutaneous injection of 1:1000 epinephrine
e. Administration of corticosteroids

219. A previously healthy 18-month-old has been in a separate room from his family. The family notices the sudden onset of coughing, which resolves in a few minutes. Subsequently, the patient appears to be normal except for increased amounts of drooling and refusal to take foods orally. Which of the following is the most likely explanation for this toddler's condition?

a. Severe gastroesophageal reflux
b. Foreign body in the airway
c. Croup
d. Epiglottitis
e. Foreign body in the esophagus

220. You receive a telephone call from the mother of a 4-year-old child with sickle-cell anemia. She tells you that the child is breathing fast, coughing, and has a temperature of 40°C (104°F). Which of the following is the most conservative, prudent course of action?

a. Prescribe aspirin and ask her to call back if the fever does not respond.
b. Make an office appointment for the next available opening.
c. Make an office appointment for the next day.
d. Refer the child to the laboratory for an immediate hematocrit, white blood cell count, and differential.
e. Admit the child to the hospital.

Fever, cough, and tachypnea in a patient with sickle cell anemia can be manifestations of pneumonia, pulmonary thromboemboli, or sepsis. Aside from being relatively common in patients with sickle-cell anemia, these diseases can be rapidly progressive and quickly fatal.

221. You are asked by a colleague to evaluate a 5-year-old boy as a second opinion. He has a history of chronic and recurrent upper respiratory tract infections, several admissions to the hospital for pneumonia, and three surgeries for PE tubes for chronic otitis media. Of note is a right-sided heart on repeated radiographs. Convinced you know the diagnosis based on history alone, you confirm your diagnosis with a biopsy of the nasal mucosa. You expect to find which of the following?

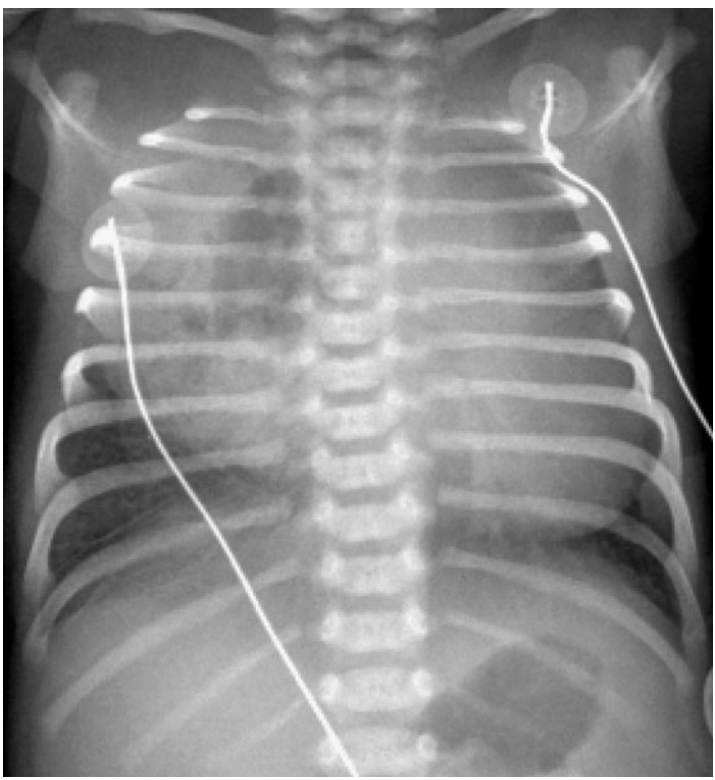
a. Eosinophilic infiltrate
b. *Bordetella pertussis*
c. Absence of nasal mucous glands
d. Random orientation of cilia
e. Nasal polyps

Patients with primary ciliary dyskinesia (immotile cilia syndrome) have dysfunctional cilia and, as such, have abnormal airway clearance.

222. A 13-year-old patient with sickle-cell anemia presents with respiratory distress; she has an infiltrate on chest radiograph. The laboratory workup of the patient reveals the following: hemoglobin 5 g/dL; hematocrit 16%; white blood cell count 30,000/μL; and arterial blood (room air) pH 7.1, P_{O_2} 35 mm Hg, and Pa_{CO_2} 28 mm Hg. These values indicate which of the following?

a. Acidemia, metabolic acidosis, respiratory alkalosis, and hypoxia
b. Alkalemia, respiratory acidosis, metabolic alkalosis, and hypoxia
c. Acidosis with compensatory hypoventilation
d. Long-term metabolic compensation for respiratory alkalosis
e. Primary respiratory alkalosis

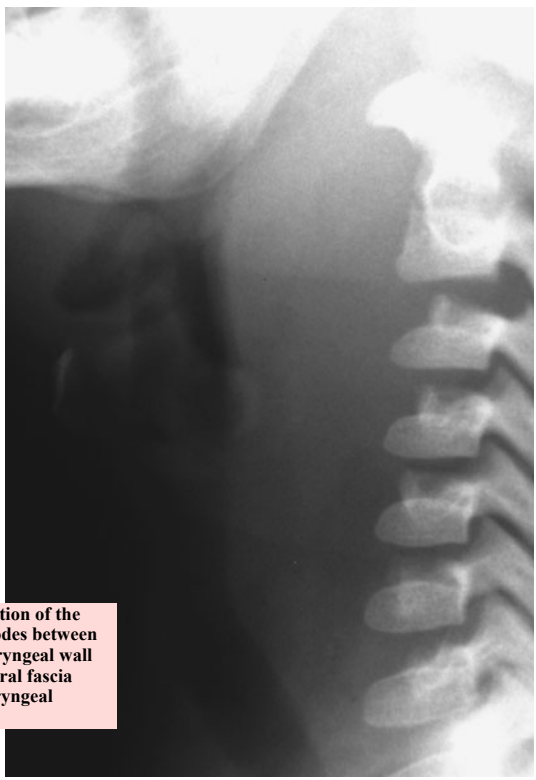
223. A 24-year-old woman arrives in the emergency center in active labor. She is at term, but received no prenatal care after 16 weeks of gestation when she lost her insurance coverage. The mother has an uncomplicated vaginal delivery. You are paged shortly after birth when the baby is noted to have respiratory distress. The infant has diminished breath sounds on the left, and the PMI is shifted toward the right. A chest radiograph is shown. The NG tube you placed earlier reveals the stomach to be below the diaphragm. Which of the following is the most likely diagnosis at this point?



(Courtesy of Susan John, MD.)

a. Congenital cystic adenomatoid malformation
b. Congenital diaphragmatic hernia
c. Bronchogenic cysts
d. Congenital lobar emphysema
e. Congenital pneumonia

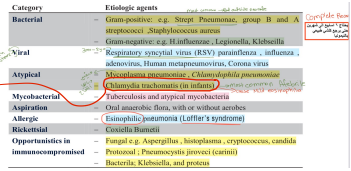
224. A 13-year-old boy has a 3-day history of low-grade fever, symptoms of upper respiratory infection, and a sore throat. A few hours before his presentation to the emergency room, he has an abrupt onset of high fever, difficulty swallowing, and poor handling of his secretions. He indicates that he has a marked worsening in the severity of his sore throat. His pharynx has a fluctuant bulge in the posterior wall. A soft tissue radiograph of his neck is shown. Which of the following is the most appropriate initial therapy for this patient?



Suppurative infection of the chain of lymph nodes between the posterior pharyngeal wall and the prevertebral fascia leads to retropharyngeal abscesses.

(Courtesy of Susan John, MD.)

a. Narcotic analgesics
b. Trial of oral penicillin V
c. Surgical consultation for incision and drainage under general anesthesia
d. Rapid streptococcal screen
e. Monospot test



Category		Etiologic agents
Bacterial	–	Gram-positive: e.g. Strept Pneumonae, group B and A streptococci ,Staphylococcus aureus
	–	Gram-negative: e.g. H.influenzae , Legionella, Klebseilla
Viral	–	Respiratory syncytial virus (RSV) parainflenza , influenza , adenovirus, Human metapneumovirus, Corona virus
Atypical	–	Mycoplasma pneumoniae , *Chlamydophila pneumoniae*
	–	Chlamydia trachomatis (in infants)
Mycobacterial	–	Tuberculosis and atypical mycobacteria
Aspiration	–	Oral anaerobic flora, with or without aerobes
Allergic	–	Esinophilic pneumonia (Loffler's syndrome)
Rickettsial	–	Coxiella Burnetii
Opportunistics in immunocompromised	–	Fungal e.g. Aspergillus , histoplasma , cryptococcus, candida
	–	Protozoal ; Pneumocystis jirovecci (carinii)
	–	Bacteria; Klebsiella, and proteus

225 توضيح نقطة

225. A 6-week-old child arrives with a complaint of "breathing fast" and a cough. On examination you note the child to have no temperature elevation, a respiratory rate of 65 breaths per minute, and her oxygen saturation to be 94%. Physical examination also is significant for rales and rhonchi. The past medical history for the child is positive for an eye discharge at 3 weeks of age, which was treated with a topical antibiotic drug. Which of the following organisms is the most likely cause of this child's condition?

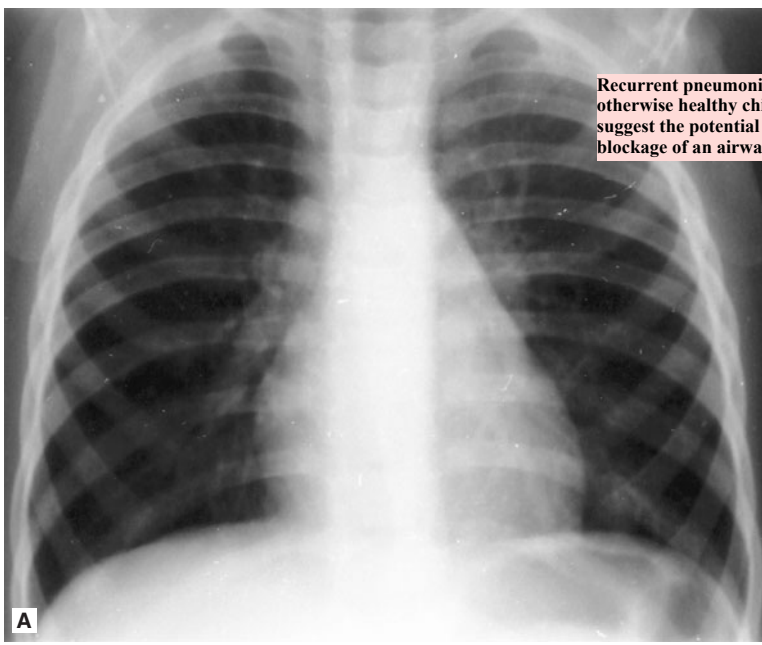
a. *Neisseria gonorrhoeae*
b. *Staphylococcus aureus*
c. Group B streptococcus
d. *Chlamydia trachomatis*
e. Herpesvirus

infant pneumonia → Afebrile
Cause Mild eisinophilia

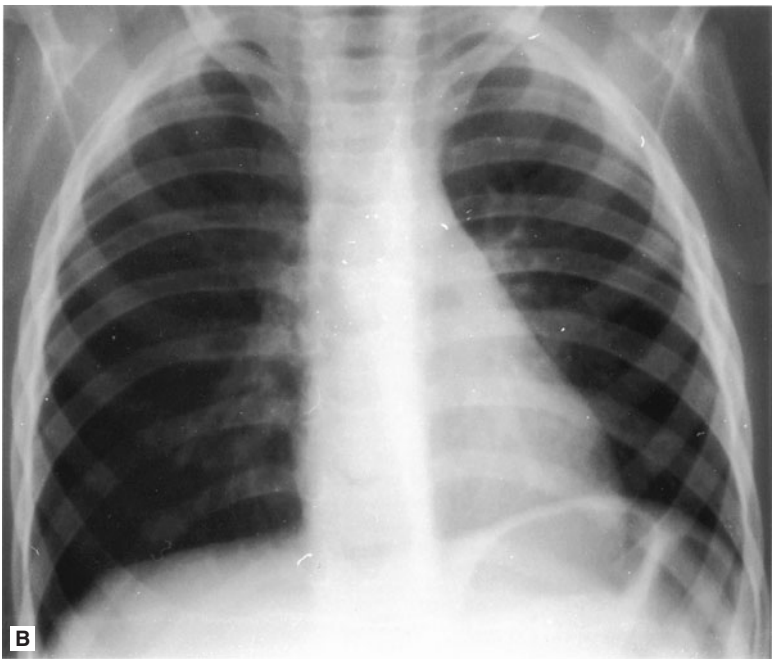
226. One of your asthmatic patients arrives for a checkup. The mother reports that the child seems to need albuterol daily, especially when exercising, and she has coughing fits that awaken her from sleep about twice a week. Her grandmother had recommended a Chihuahua as a "cure" for her asthma, but her mother has seen no difference since the arrival of the pet. Appropriate treatment measures would include which of the following?

a. Short-acting, inhaled β-agonists, as needed
b. Daily leukotriene modifier with short-acting β-agonist
c. Inhaled nedocromil with short-acting β-agonists
d. Medium-dose, inhaled corticosteroids with short-acting β-agonists
e. High-dose, inhaled corticosteroids with theophylline and short-acting β-agonists

227. A previously healthy 2-year-old black child has developed a chronic cough during the previous 6 weeks. He has been seen in different emergency rooms on two occasions during this period and has been placed on antibiotics for pneumonia. Upon auscultation, you hear normal breath sounds on the left. On the right side, you hear decreased air movement during inspiration but none upon expiration. Inspiratory (A) and expiratory (B) radiographs of the chest are shown below. Which of the following is the most appropriate next step in making the diagnosis in this patient?



Recurrent pneumonias in an otherwise healthy child should suggest the potential for anatomic blockage of an airway.



(Courtesy of Susan John, MD.)

a. Measure the patient's sweat chloride.
b. Consult pediatric surgery for bronchoscopy.
c. Prescribe broad-spectrum oral antibiotics.
d. Initiate a trial of inhaled β-agonists.
e. Prescribe appropriate doses of oral prednisone.

Questions 228 to 230

228-c, 229-d, 230-b

Match each management procedure below with the appropriate set of arterial blood gas results of patients spontaneously breathing room air. Each lettered option may be used once, more than once, or not at all.

Base	P_{CO_2} (mm Hg)	P_{O_2} (mm Hg)	Excess pH (mEq/L)
a. 7.20	28	95	16
b. 7.20	70	41	2
c. 7.64	18	94	1
d. 7.34	32	39	8

228. Have patient rebreathe in a paper bag.

229. Administer F_{IO_2} 0.4.

230. Perform thoracentesis to remove air under pressure.

Questions 231 to 234

231-a, 232-c, 233-b, 234-d.

Match each management procedure below with the appropriate arterial blood gas results of patients spontaneously breathing room air. Each lettered option may be used once, more than once, or not at all.

Base	P_{CO_2} (mm Hg)	P_{O_2} (mm Hg)	Excess pH (mEq/L)
a. 6.92	101	19	15
b. 7.36	60	50	7
c. 7.50	46	76	11
d. 7.41	60	90	10

231. Place the patient on a ventilator with an F_{IO_2} of 1.0.

232. Discontinue diuretics, discontinue base, and increase KCl in IV fluids.

233. Perform tonsillectomy.

234. Repeat the test because of obvious laboratory error.

The Respiratory System

Answers

201. The answer is d. *(Hay et al, pp 22-23. Kliegman et al, pp 720-721. Rudolph et al, p 89.)* Infants born to mothers with gestational diabetes are at risk for being large for their gestational age and thus at increased risk for peripheral nerve injuries such as Erb-Duchenne and phrenic nerve paralysis. An ultrasound or fluoroscopy of the chest would reveal asymmetric diaphragmatic motion in a seesaw manner. With a negative chest radiograph, a chest CT would not be helpful at this point. Bronchoscopy would help delineate airway abnormalities and foreign bodies, but would not identify phrenic nerve paralysis.

202. The answer is e. *(Hay et al, pp 678-681. Kliegman et al, pp 1803-1816. McMillan et al, pp 1425-1437. Rudolph et al, pp 1967-1979.)* Cystic fibrosis (CF) is a multisystem disease caused by an abnormally functioning cystic fibrosis transmembrane regulator (CFTR) protein. Abnormal secretions are produced as a result of decreased permeability of ionized chloride in the secretory epithelium of a number of organs. Progressive lung failure is caused by accumulation of viscid secretions that obstruct the airway and lead to infection, bronchiectasis, and inflammatory changes. Survival has improved markedly during the past few decades as a result of prompt recognition of CF and aggressive treatment; the median age at death has increased from less than 10 years to more than 30 years. Therapeutic approaches have included inhalation therapy, chest physical therapy, aggressive antibiotic administration, bronchodilators, oxygen, and nutritional support. Heart–lung transplants have prolonged life and improved qualify of life for some terminal patients. Several new approaches to the treatment of CF have been proposed, namely, the use of amiloride, purified human plasma α_1-antitrypsin, recombinant DNAase, and gene therapy. The rationale for these therapeutic modalities is that they focus directly on ameliorating or correcting the basic deficit: amiloride by inhibiting sodium, and with it water reabsorption, thereby improving airway hydration; α_1-antitrypsin by counteracting the effects on the lungs of neutrophil elastase, a proteolytic enzyme released by neutrophils; DNAase by reacting with DNA released by dead leukocytes to reduce sputum viscosity; and gene therapy by altering

genetic material. Lung cancer does not appear to be associated with cystic fibrosis.

Unlike many other tests, there is almost no overlap in chloride values in sweat between patients with cystic fibrosis and normal control participants. A chloride concentration of greater than 60 mEq/L is diagnostic, values less than 40 are normal, and values between 40 and 60 are intermediate. Genetic studies that assay for about 30 of the most common mutations known to cause CF are available. A number of states have included a test for immunoreactive trypsinogen in their newborn screening programs, and when combined with confirmatory testing, the sensitivity has been reported to be as high as 95%.

Conditions other than cystic fibrosis can manifest an elevated sweat chloride, including adrenal insufficiency, ectodermal dysplasia, nephrogenic diabetes insipidus, hypothyroidism, and malnutrition.

203. The answer is a. *(Hay et al, pp 506-507. Kliegman et al, pp 1773-1777. McMillan et al, pp 699-700, 1391-1394. Rudolph et al, pp 1984-1985.)* Of the choices given and with the findings on the radiograph (patchy infiltrates with flat diaphragms), monitoring oxygenation and hydration status is the most appropriate course of action as bronchiolitis is the most likely diagnosis. Bronchodilators and a short course of steroids are treatments for asthma, a less likely diagnosis in this patient without previous wheezing episodes and without a family history of atopy; a single dose of short-acting β-agonist might be tried in this patient but would be expected to be of limited benefit for a patient with bronchiolitis. Viral croup (a single dose of steroids) and epiglottitis (emergency intubation and antibiotics) are not reasonable choices because there are no signs of extrathoracic airway obstruction. Pneumothorax (chest tube placement) may be required if unilateral breath sounds were present or if the radiograph demonstrated collapse; neither is noted in this case.

The most likely cause of the illness is infection by respiratory syncytial virus, which causes outbreaks of bronchiolitis of varying severity, usually in the winter and spring. Other viruses, such as parainfluenza and the adenoviruses, have also been implicated in producing bronchiolitis. Treatment is generally supportive in this usually self-limited condition.

204. The answer is b. *(Hay et al, pp 517-521. Kliegman et al, pp 1795-1800. McMillan et al, pp 1407-1411. Rudolph et al, pp 1980-1982.)* The x-ray reveals a lung empyema on the left side, characterized by nearly complete white out of that side by the pleural or extrapleural fluid collection. Lung abscesses are usually caused by *S aureus, S pneumoniae, or S pyogenes*. These organisms,

previously sensitive to penicillin, now have a variety of resistance patterns requiring extended spectrum antibiotics or vancomycin. Patients who do not improve quickly with antibiotic therapy alone are also surgical candidates.

205. The answer is d. *(Hay et al, p 349. Kliegman et al, pp 1789-1790. McMillan et al, p 753. Rudolph et al, pp 366-367.)* Hydrocarbons with low viscosity and high volatility are the most likely agents to cause respiratory symptoms. Gasoline, kerosene, and furniture polish (which contain hydrocarbons) are common agents responsible for hydrocarbon aspiration. Hydrocarbon aspiration can produce dyspnea, cyanosis, and respiratory failure. Treatment is symptomatic, sometimes requiring intubation and mechanical ventilation. Induction of emesis is contraindicated, as this may cause further aspiration. Placement of a nasogastric tube is used only in high-volume ingestions or when the hydrocarbon is mixed with another toxin. Charcoal is not useful, and no intravenous binding agent is available.

206. The answer is d. *(Hay et al, pp 521-523, 1197-1200. Kliegman et al, pp 1240-1254. McMillan et al, pp 1142-1155. Rudolph et al, pp 949-959.)* The key to controlling tuberculosis in children and eradicating the disease is early detection and appropriate treatment of adult cases; the child, once infected, is at lifelong risk for the development of the disease and for infecting others, unless given appropriate prophylaxis. The usual source of the disease is an infected adult, since smaller children are not infectious because they typically are unable to produce enough intrathoracic pressure with a cough to spread the disease. Household contacts of a person with newly diagnosed active disease have a considerable risk of developing active tuberculosis, and the risk is greatest for infants and children. Therefore, when tuberculosis is diagnosed in a child, the immediate family and close contacts should be tested with tuberculin skin tests and chest radiographs and treated appropriately when indicated. Bronchoscopy would be indicated only in unusual circumstances. Three to eight weeks is required after exposure before hypersensitivity to tuberculin develops. This means that the tuberculin test must be repeated in exposed persons if there is a negative reaction at the time that contact with the source of infection is broken. TB skin tests are usually negative in infants of this age, even when active disease is ongoing. A logical preventive measure is the administration of isoniazid to the 6-week-old baby for 3 months when a Mantoux (purified protein derivative, PPD) can then be placed. Transmission of tuberculosis occurs when bacilli-laden, small-sized droplets are dispersed into the air by the cough or sneeze of an

infected adult. Small children with primary pulmonary tuberculosis are not considered infectious to others, and they are not capable of coughing up and producing sputum. Sputum, when produced in child of this age, is promptly swallowed, and for this reason specimens for microbial confirmation can be obtained by means of gastric lavage from smaller children.

In the child described in the case, the chest film is abnormal, suggesting active TB disease. While the medications listed in the answer are part of the treatment for TB disease, they are typically used with several other medications.

207. The answer is e. *(Hay et al, pp 529-530. Kliegman et al, pp 1824-1826. McMillan et al, pp 1438-1440. Rudolph et al, pp 1997-1999.)* This child likely has idiopathic pulmonary hemosiderosis (IPH). While fever, respiratory distress, and localized chest radiograph findings should point initially toward an acute pneumonia, the history of recurrence, the rapid clearing of radiographic findings, and the hemoptysis suggest pulmonary hemorrhage. The examination finding of digital clubbing suggests a chronic process. Other typical findings would include microcytic and hypochromic anemia, low serum iron levels, and occult blood in the stool (from swallowed pulmonary secretions). Bronchoalveolar lavage will reveal hemosiderin-laden macrophages and would be most likely to make the diagnosis. A distinct subset of patients with pulmonary hemosiderosis have hypersensitivity to cow's milk (the association is called Heiner syndrome) and may improve with a diet free of cow's milk products.

208. The answer is a. *(Hay et al, p 481. Kliegman et al, pp 1744-1775. Rudolph et al, p 1265.)* Small children frequently introduce any number of small objects into their noses, ranging from food to small toys. Initially, only local irritation occurs. Later, as prolonged obstruction is seen, symptoms increase to include worsening of pain, and a purulent, malodorous, bloody discharge can be seen. Unilateral nasal discharge in the presence of obstruction suggests the need to examine the patient for a nasal foreign body.

Polyps are a possible cause of unilateral nasal obstruction, but at 18 months of age they are unusual and would suggest a diagnosis of cystic fibrosis. While not impossible, cystic fibrosis is rare in a black child. Frontal sinusitis usually does not cause unilateral symptoms, and sinusitis in an 18-month-old child is rare owing to poor sinus development. Similarly, deviated septum is not found in small children. Choanal atresia would present in the newborn period with periods of respiratory distress at rest with improvement with crying.

209. The answer is e. *(Hay et al, pp 487-489, 536-537. Kliegman et al, pp 94-97. McMillan et al, pp 1441-1443. Rudolph et al, pp 1937-1941.)* A nasopharyngeal airway, the use of nasal CPAP, and tonsillectomy and adenoidectomy can be effective treatments for obstructive sleep apnea (OSA). However, the diagnosis of OSA should first be made by polysomnography (sleep study) to exclude other causes of snoring. Administering oxygen may decrease the respiratory drive in severe OSA, and thus should be used only with caution. Untreated OSA can lead to *cor pulmonale,* as well as growth and developmental abnormalities.

210. The answer is b. *(Hay et al, pp 324, 536. Kliegman et al, pp 1835-1837. McMillan et al, pp 1456-1457. Rudolph et al, pp 149-150, 1981.)* Tension pneumothorax, a recognized complication of staphylococcal (and other) pneumonia is caused by toxin production by the bacteria leading to rupture of the alveoli into the pleural space. Tension pneumothorax can be quickly lethal if not recognized and treated; this makes a high index of suspicion and prompt diagnosis mandatory. The other complications can also occur but do not require so prompt a response. Immediate action to relieve the tension is mandatory, usually accomplished by inserting a needle or catheter into the second or third intercostal spaces in the midclavicular line, with the patient supine.

211. The answer is a. *(Hay et al, p 502. Kliegman et al, pp 1766-1767, McMillan et al, pp 1506-1507, Rudolph et al, p 1944.)* Bacterial tracheitis is an uncommon, but severe and life-threatening sequelae of a viral laryngotracheobronchitis. The typical story is that presented in the case, with several days of viral upper respiratory symptoms, followed by an acute elevation of temperature and an increase in respiratory distress. Inspiratory stridor is typical in croup; the biphasic stridor and high fever in this patient should be a clue to consider alternative diagnoses. Children may also present acutely and without the initial viral symptoms. The differential must include epiglottitis; the lack of drooling and dysphagia (and the rarity of epiglottitis) help make this a case of tracheitis. Management for tracheitis includes establishing an airway with endotracheal intubation and IV antibiotics. Special attention is focused on preservation of the airway, as even intubated children with tracheitis can have secretions thick and copious enough to occlude the airway.

Oral antibiotics and outpatient follow-up for a patient with respiratory distress and toxic appearance is never appropriate. Inhaled epinephrine and

oral steroids as well as observation in a cool mist tent suggest a diagnosis of croup, a disease that presents without high fever but with stridor a few days after an upper respiratory infection. In the case presentation, the fever and toxic appearance differentiate this condition from viral croup. Inhaled steroids suggest asthma, a diagnosis unlikely in a patient with high fever as outlined.

212. The answer is d. *(Hay et al, pp 501-502. Kliegman et al, pp 1763-1766. McMillan et al, pp 695-696. Rudolph et al, p 1276.)* In the past, epiglottitis was most commonly caused by invasive *H influenzae* type B. Due to the widespread use of the Hib vaccine, this condition is now more commonly caused by group A β-hemolytic streptococcus, *Moraxella catarrhalis,* or *S pneumoniae*. The radiography shows the typical "thumb" sign of a swollen epiglottis. Epiglottitis is a life-threatening form of infection-produced upper airway obstruction. The course of the illness is brief and prodromal symptoms are lacking. The patient experiences a sudden onset of sore throat, high fever, and prostration that is out of proportion to the duration of the illness. Drooling and difficulty in swallowing, a muffled voice, and preference for a characteristic sitting posture with the neck hyperextended may be noted. Radiography of the neck, which may delay definitive treatment, is often avoided. Rather, preparations are made for immediate intubation by skilled personnel, and any attempt to visualize the epiglottis should be avoided. Morbidity and mortality are usually related to a delay in establishing an airway early in the disease.

213. The answer is c. *(Hay et al, pp 1233-1234. Kliegman et al, pp 1506-1507. McMillan et al, pp 1370-1373. Rudolph et al, pp 1110-1111.)* The presentation described is characteristic of visceral larva migrans from infestation with a common parasite of dogs, *Toxocara canis.* Dirt-eating children ingest the infectious ova. The larvae penetrate the intestine and migrate to visceral sites, such as the liver, lung, and brain, but do not return to the intestine, so the stools do not contain the ova or parasites. The diagnosis can be made by a specific enzyme-linked immunosorbent assay (ELISA) for *Toxocara.*

214. The answer is b. *(Hay et al, pp 476-479. Kliegman et al, pp 1749-1752. McMillan et al, pp 1470-1476. Rudolph et al, pp 1263-1264.)* Maxillary and ethmoid sinuses are large enough to harbor infections from infancy. Frontal sinuses are rarely large enough to harbor infections until the sixth to tenth year of life. Sphenoid sinuses do not become large until about the third to fifth year of life. In general, a "cold" lasting longer than 10 to 14 days with fever and facial pain is indicative of sinusitis. Examination of the nose can

reveal pus draining from the middle meatus in maxillary, frontal, or anterior ethmoid sinusitis. Pus in the superior meatus indicates sphenoid or posterior ethmoid sinuses. Diagnosis is on clinical grounds and can be difficult. Positive findings on plain sinus films in a symptomatic child are supportive of sinusitis. CT scans are more sensitive, but are usually reserved for the more complicated cases. The treatment is usually oral antibiotics for 10 to 14 days. Decongestants and antihistamines have not been shown to be helpful or necessary.

Brain abscess is unlikely in this patient who demonstrates no neurologic symptoms. A streptococcal throat infection should present with acute onset of sore throat without other signs and symptoms of upper respiratory infection. Sphenoid sinusitis usually does not cause facial pain or drainage from the middle meatus. The child might have a middle-ear infection simultaneous with a sinusitis, but her lack of ear pain suggests otherwise.

215. The answer is d. *(Hay et al, pp 500-502. Kliegman et al, pp 1762-1766. McMillan et al, pp 694-695, 1505-1508. Rudolph et al, pp 1275-1276.)* The signs of illness described are those involving the airway above the point at which the trachea enters the neck and leaves the thorax, resulting in inspiratory stridor such as in croup. The extrathoracic airway tends to collapse on inspiration, producing the characteristic findings this patient demonstrates; therapy usually is with a single dose of steroids. Agents causing croup include parainfluenza types 1 and 3, influenza A and B, RSV, and occasionally other viruses. Treatment is usually supportive, but racemic epinephrine and corticosteroids reduce the length of time in the emergency room and hospitalizations.

Intrathoracic airway diseases, such as asthma (bronchodilators and short course of steroids) or bronchiolitis (supportive therapy including observation for hypoxia or dehydration alone), produce breathing difficulty on expiration, with expiratory wheezing, prolonged expiration, and signs of air trapping due to the increased narrowing during expiration as the airways are exposed to the same intrathoracic pressure changes as the alveoli.

Acute airway foreign body (rigid bronchoscopy) should result in differential air movement between the two lungs. The typical case of epiglottis (intubation and antibiotics) presents acutely and the child is toxic in appearance; it is now a rare disease with the widespread use of vaccines.

216. The answer is e. *(Hay et al, pp 1049-1060. Kliegman et al, pp 953-970. McMillan et al, pp 2404-2410. Rudolph et al, pp 1956, 1959.)* The patient in the question has well-controlled, moderately persistent asthma; this suggests that she is likely on inhaled steroids. Failure to rinse her mouth after

administration of this medication can result in localized candida infection (thrush). Discontinuation of her asthma medications is contraindicated. While it is possible she has an immune dysfunction, simply rinsing her mouth is more likely to be both diagnostic and therapeutic.

217. The answer is e. *(Hay et al, pp 520-521. Kliegman et al, pp 1278-1281. McMillan et al, pp 1395-1400. Rudolph et al, pp 949-959, 965-967, 1980-1982.)* The radiograph shown has reticulonodular opacities in the right upper lobe and prominence of the right hilum (lymphadenopathy) consistent with *M pneumoniae*. Infections with *M pneumoniae* are common in older children and young adults. Although the infection typically produces an interstitial infiltrate, its effects are characteristically nonspecific, and it can produce lobar pneumonia as well. It can produce upper respiratory infection, pharyngitis, otitis media and externa, bronchiolitis, hemolytic anemia, and Guillain-Barré syndrome. Treatment of choice is a macrolide antibiotic.

S aureus traditionally is seen in infants less than 6 months of age; *H influenzae* is rarely seen because of the widespread use of *H influenzae* B vaccine. At this age, a child with *M tuberculosis* presents most typically with hilar adenopathy and localized lobar pneumonia in the upper lobe, and *S pneumoniae* causes the sudden onset of high fever and a lobar pneumonia, often with pleural effusion. A TB skin test for this patient would be reasonable.

218. The answer is a. *(Hay et al, pp 1069-1071. Kliegman et al, pp 983-984. McMillan et al, p 2398. Rudolph et al, pp 821-822.)* Anaphylaxis is a medical emergency that must be recognized and managed promptly. The onset of symptoms is usually dramatic. In the case presented, the change in voice suggests impending airway compromise, making airway stabilization is your top priority. The other choices are all important in managing anaphylaxis and, in reality, may be occurring concurrently; of those listed, subcutaneous epinephrine would be the first medication used. Additional treatment can include plasma expanders, diphenhydramine, and cimetidine, as indicated by the clinical course of the patient. Additional treatment such as administration of corticosteroids should be started early, but the effect will be delayed.

219. The answer is e. *(Hay et al, pp 504-506. Kliegman et al, pp 1769-1770. McMillan et al, pp 693-694. Rudolph et al, pp 1397-1398.)* Many types of objects produce esophageal obstruction in young children, including small toys, coins, and food. Most are lodged below the cricopharyngeal muscle at the level of the aortic arch. Initially, the foreign body may cause a cough, drooling,

and choking. Later, pain, avoidance of food (liquids are tolerated better), and shortness of breath can develop. Diagnosis is by history (as outlined in the question) and by radiographs (especially if the object is radiopaque). The usual treatment is removal of the object via esophagoscopy.

Severe gastroesophageal reflux would likely not present with acute findings as those outlined in the question, but rather with ongoing respiratory symptoms (asthma or pneumonia) or failure to thrive. Symptoms of foreign body in the airway may present acutely as described with resolution as the offending object settles in the lung, but the symptoms of failure to drink and to begin drooling would not be expected. Croup causes a barking cough, often at night, several days after an acute upper respiratory infection. Epiglottitis can be diagnosed in a toxic-appearing, febrile child with stridor.

220. The answer is e. *(Hay et al, pp 845-848. Kliegman et al, pp 2026-2031. McMillan et al, pp 1696-1700. Rudolph et al, pp 1531-1534.)* Fever, cough, and tachypnea in a patient with sickle cell anemia can be manifestations of pneumonia, pulmonary thromboemboli, or sepsis. Aside from being relatively common in patients with sickle-cell anemia, these diseases can be rapidly progressive and quickly fatal. It is therefore important for the patient to be evaluated and treated on an emergency basis. The treatment requires hospitalization, because it will almost certainly include systemic antibiotics, intravenous fluids, oxygen, and perhaps blood transfusion.

221. The answer is d. *(Hay et al, p 509. Kliegman et al, pp 1817-1819. McMillan et al, pp 1422-1424. Rudolph et al, p 1949.)* Patients with primary ciliary dyskinesia (immotile cilia syndrome) have dysfunctional cilia and, as such, have abnormal airway clearance. Described structural aberrations include abnormal cytoskeletal proteins and defects in the dynein arms. Kartagener syndrome (the triad of situs inversus, chronic sinusitis and otitis media, and airway disease) is associated with primary ciliary dyskinesia; approximately 50% of patients with the latter also have the former. Although it is a chronic disease, patients with PCD can have a normal life span.

Allergic rhinitis can cause polyps and eosinophilia on a nasal smear, but the story is not an allergic one. *B pertussis* infection is not commonly found in immunized children, but it can be found in adults. Pertussis does not cause the chronic and recurrent findings in the vignette.

222. The answer is a. *(Hay et al, pp 495-496. Kliegman et al, pp 1726-1727. McMillan et al, pp 2582-2587. Rudolph et al, pp 1656-1657.)* The low

pH in the arterial blood can be called *acidemia.* In this context, it is likely that the hydrogen ions come from lactic acid produced by anaerobic metabolism in tissues with inadequate oxygen delivery. Inadequate oxygenation is caused by the low P_{O_2}, the low oxygen-carrying capacity of the blood (Hgb 5 g/dL), and circulatory inadequacy due to the sickling itself and to the vascular disease it produces. The low P_{CO_2} reflects the hyperventilation, which is secondary to the respiratory difficulty, and to the anemia, and is also respiratory compensation for the metabolic acidosis.

223. The answer is a. *(Hay et al, pp 516-517. Kliegman et al, p 1784. McMillan et al, p 1453. Rudolph et al, pp 190, 202.)* Congenital cystic adenomatoid malformation (CCAM) is thought to arise from an embryonic disruption before the thirty-fifth day that causes improper development of bronchioles. The cystic mass is usually identified on prenatal ultrasound around the 20th week. Large lesions (as that noted on the radiograph on the right side) may compress the affected lung and cause pulmonary hypoplasia, which may cause midline shift away from the lesion (note the heart is shifted toward the left on the radiograph). Treatment is typically surgical excision of the affected lobe. Some patients may be at risk for primary pulmonary malignancy.

224. The answer is c. *(Hay et al, p 485. Kliegman et al, pp 1754-1756. McMillan et al, pp 1493-1494. Rudolph et al, p 1944.)* Suppurative infection of the chain of lymph nodes between the posterior pharyngeal wall and the prevertebral fascia leads to retropharyngeal abscesses. The most common causative organisms are *S aureus,* group A β-hemolytic streptococci, and oral anaerobes. Presenting signs and symptoms include a history of pharyngitis, abrupt onset of fever with severe sore throat, refusal of food, drooling, and muffled or noisy breathing. A bulge in the posterior pharyngeal wall is diagnostic, as are radiographs of the lateral neck that reveal the retropharyngeal mass (the radiograph in the question demonstrates thickening of the prevertebral space). Palpation (with adequate provision for emergency control of the airway in case of rupture) reveals a fluctuant mass. Treatment should include incision and drainage if fluctuance is present. All of the wrong answers listed would delay definitive treatment and/or might be life threatening.

225. The answer is d. *(Hay et al, p 520. Kliegman et al, pp 1285-1287. McMillan et al, pp 984-985. Rudolph et al, p 930.)* Chlamydiae organisms, sexually transmitted among adults, are spread to infants during birth from genitally infected mothers. The sites of infection in infants are the conjunctivae

and the lungs, where chlamydiae cause inclusion conjunctivitis and afebrile pneumonia, respectively, in infants between 2 and 12 weeks of age. Diagnosis is confirmed by culture of secretions and by antibody titers. In adolescents, chlamydial infections may be a cause of cervicitis, salpingitis, endometritis, and epididymitis and appear to be an important cause of tubal infertility. The most common treatment for this condition includes macrolide antibiotics orally, which clears both the nasopharyngeal secretions when conjunctivitis is present and prevents the pneumonia that can occur later. Topical treatment for chlamydia conjunctivitis is not effective in clearing the nasopharynx. Early treatment with oral macrolides is, however, associated with an increased incidence in the development of idiopathic hypertrophic pyloric stenosis; their use in a neonate is with caution.

N gonorrhoeae can cause a sepsis syndrome in children (and not just respiratory symptoms), but its presentation would be in the first days of life and not at 6 weeks; the child would be toxic. *S aureus*, and more unusually Group B streptococcus (which more likely would occur in the first days of life), can cause pneumonia in a child of this age, but the presentation would more likely be of a toxic, febrile child. Herpesvirus, when it causes pneumonia, does so more likely in a child in the first days of life; the child is toxic.

226. The answer is d. *(Hay et al, pp 1049-1060. Kliegman et al, pp 953-970. McMillan et al, pp 2404-2410. Rudolph et al, p 1953.)* Asthma may be classified by severity based on the frequency of symptoms. Patients with *mild intermittent* asthma have symptoms less than two times a week and have less than two nighttime episodes a month. These patients do not require daily medication and only short-acting β-agonists are needed. The second classification is *mild persistent* asthma; these children have symptoms more than two times a week, and have 3 to 4 nights a month with symptoms. These patients may be managed with a number of anti-inflammatory choices, including low-dose, inhaled corticosteroids, cromolyn, or a leukotriene inhibitor, and use short-acting β-agonists for rescue. Our patient has *moderate persistent* asthma; she has daily symptoms and difficulty at night more than once a week. Her treatment should consist of medium-dose corticosteroids, or a combination of low-dose corticosteroids and a long-acting β-agonist; alternatives include a leukotriene modifier or sustained release theophylline. Patients with *severe persistent* asthma have continual symptoms and frequent nighttime symptoms. This group requires daily high-dose glucocorticoids as well as long-acting β-agonists; they may require oral steroids as well.

227. The answer is b. *(Hay et al, pp 504-506. Kliegman et al, pp 1769-1770. McMillan et al, pp 693-694. Rudolph et al, pp 1277-1278.)* Recurrent pneumonias in an otherwise healthy child should suggest the potential for anatomic blockage of an airway. In the patient in this question, the findings on clinical examination suggest a foreign body in the airway. Inspiratory and expiratory films can be helpful. Routine inspiratory films are likely to appear normal or near normal (as outlined in the question and noted in the first radiograph). Expiratory films will identify air trapping behind the foreign body (as noted on the second radiograph). It is uncommon for the foreign body to be visible on the plain radiograph; a high index of suspicion is necessary to make the diagnosis. Suspected foreign bodies in the airway are potentially diagnosed with fluoroscopy, but rigid bronchoscopy is not only diagnostic but also the treatment of choice for removal of the foreign body.

228-230. The answers are 228-c, 229-d, 230-b. *(Hay et al, pp 495-496. Kliegman et al, pp 1726-1727. McMillan et al, pp 2582-2587. Rudolph et al, pp 278-284, 1656-1657.)* The laboratory results of row C indicate a striking respiratory alkalosis. This could be secondary to voluntary hyperventilation or inappropriate respirator settings for a patient on a ventilator. The findings are also typical of acute hyperventilation syndrome secondary to anxiety; such a patient can complain of dyspnea, chest pain, tingling, and dizziness, and can even have generalized convulsions secondary to low ionized calcium levels. Rebreathing into a paper bag can be both therapeutic and diagnostic.

The blood gases of row D are the only ones shown that are relatively normal, except for a low-oxygen partial pressure. The mild respiratory alkalosis and metabolic acidosis can be a consequence of the hypoxia. These results could be obtained in a patient with moderately severe pneumonia, bronchiolitis or asthma, or secondary to ventilation-perfusion inequality with some areas of the lung underventilated with respect to perfusion. This cause of hypoxia can be easily corrected by giving the patient relatively small increases in oxygen concentration to breathe. These results would also be typical of findings in patients with right-to-left shunting of blood, as in tetralogy of Fallot, in which case giving oxygen would not help.

The results in row A show fairly severe metabolic acidosis with respiratory compensation and without hypoxia. These would be typical for someone in early shock and would most commonly be seen in children with diarrhea. Treatment of this type of acidosis is hydration.

The blood gases of row B demonstrate an uncompensated respiratory acidosis with hypoxia but with no metabolic acidosis. This is compatible with

acute hypoventilation, which could be produced by a tension pneumothorax, for example. This can be treated easily by placing a needle or catheter in the pleural space and evacuating the air.

231-234. The answers are 231-a, 232-c, 233-b, 234-d. (*Hay et al, pp 495-496. Kliegman et al, pp 1726-1727. McMillan et al, pp 2582-2587. Rudolph et al, pp 278-284, 1656-1657.*) The data on row A indicate severe acidemia and severe hypoxia with a marked respiratory acidosis and metabolic acidosis. These are manifestations of severe ventilatory failure, probably accompanied by circulatory failure or cardiac arrest. This mandates the most aggressive therapy, including assisted ventilation with administration of high oxygen levels. Other measures to restore circulation and improve the acidemia are also indicated.

The results of row C show metabolic alkalosis. The high P_{CO_2} and low P_{O_2} result from compensatory hypoventilation. This can all be secondary to excessive body potassium losses from diuretics.

The results in row B indicate respiratory acidosis with metabolic compensation, indicating chronic upper airway obstruction. A common cause of chronic hypoventilation in children is hypertrophied tonsils and adenoids, which may be an indication for tonsillectomy or adenoidectomy (or both).

The blood gases of row D are impossible in a patient breathing room air. The P_{CO_2} cannot go up without the P_{O_2} dropping roughly proportionately. An increase in P_{CO_2} of 20 mm Hg, from 40 to 60 mm Hg, should therefore produce a fall in P_{O_2} from 90 to 70 mm Hg. The test should be repeated after the blood gas equipment has been checked and recalibrated.

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